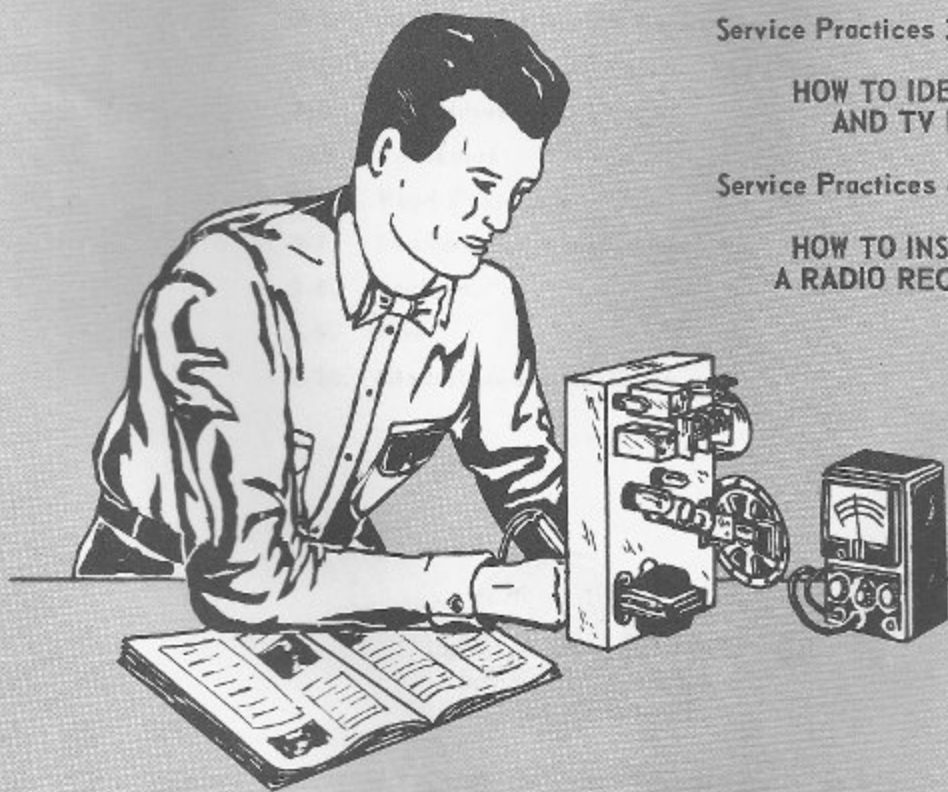


ELECTRONIC FUNDAMENTALS



Service Practices 3:

HOW TO IDENTIFY RADIO
AND TV HARDWARE

Service Practices 4:

HOW TO INSTALL
A RADIO RECEIVER



RCA INSTITUTES, INC.

A SERVICE OF RADIO CORPORATION OF AMERICA

New York.

N. Y.

ELECTRONIC FUNDAMENTALS

SERVICE PRACTICES 3

HOW TO IDENTIFY RADIO AND TV HARDWARE

- 3-1. Ordering Hardware
- 3-2. Antenna and Ground Hardware
- 3-3. Clips, Connectors, Jacks, and Plugs
- 3-4. Dial Hardware
- 3-5. Fasteners
- 3-6. Wood Fasteners
- 3-7. Insulators and Insulation
- 3-8. Sockets
- 3-9. Wire
- 3-10. Miscellaneous Hardware



RCA INSTITUTES, INC.

**A SERVICE OF RADIO CORPORATION OF AMERICA
HOME STUDY SCHOOL**

350 West 4th Street, New York 14, N. Y.

Service Practices 3

INTRODUCTION

Radio and TV hardware comes in many kinds, shapes, and sizes; no complete listing is possible in a volume of this size. However, more than 150 of the most often used items of hardware are illustrated and discussed in the following pages. Radio and television servicemen must know where, when, and how these parts are used, and what they are called.

3-1. ORDERING HARDWARE

When you order hardware, you may save time and money by giving all the information necessary to identify the items you want. If you are ordering from a radio and television parts distributor's catalog, be sure to include catalog part numbers (if any) as well as a full description of what you want. Note, too, the special information given in these pages about ordering certain items.

3-2. ANTENNA AND GROUND HARDWARE

The items shown in this section are used in installing radio and television receivers. How and where they are used is explained in Service Practices booklet 5. In this lesson, learn what they look like. Figure 3-1 shows different kinds of hardware used for antenna and ground installations.

3-3. CLIPS, CONNECTORS, JACKS, AND PLUGS.

Sometimes connections are made so that parts or sections may be removed easily for testing or replacement. Also, it is sometimes necessary to make a temporary con-

nection while testing a part or circuit. Some parts, such as fuses, must be replaced fairly often. For these reasons, the hardware shown in this section is used. Special uses of some of the items are given in later lessons in this course. Right now, become familiar with how they look.

Clips are used to make temporary connections to circuits being tested. They are usually fastened to connecting wires or to test probes. Some clips can be fastened to the wire by a set screw in the shank, while others must be soldered to the wire. Figure 3-2 shows some of the many kinds of clips available. The *alligator clip* and the *crocodile clip* are used while making tests in tight places. Their narrow jaws make contact without touching nearby parts. The *Pee-wee clip* is for clipping on to wire, studs, chassis, and so on. The *Twin-Clip* is very handy for making connections between two wires or leads. The *battery clip* is used to make contact with storage-battery terminals. *Fahnestock clips* are sometimes used on antenna lead-in strips and to make antenna and ground connections to radios. They are not as good as screw connections because they loosen easily and make poor contact. Fahnestock clips are normally sold by the gross (144). The other clips are sold singly or in lots of 10 or 12.

Fuse Clips, Connectors, and Holders. The small, low-amperage fuses used in home and car radios are held in place in three different ways. The first way uses *fuse clips*, shown in Fig. 3-3. These clips are used only where they may be covered so that no one will accidentally touch them. The second way uses *fuse posts*, as shown in the figure. The front end of the fuse post is placed on the front or rear panel of radio equipment so that the fuse may be easily replaced. The

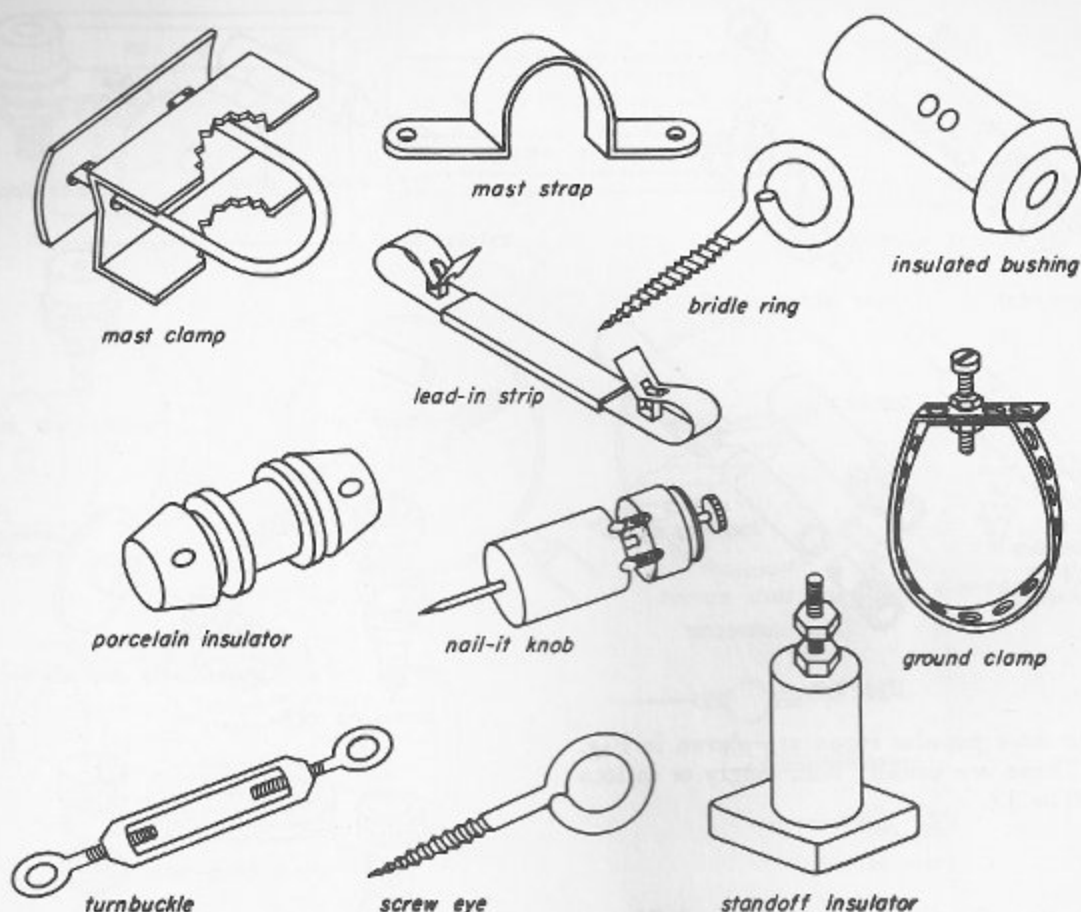


Fig. 3-1

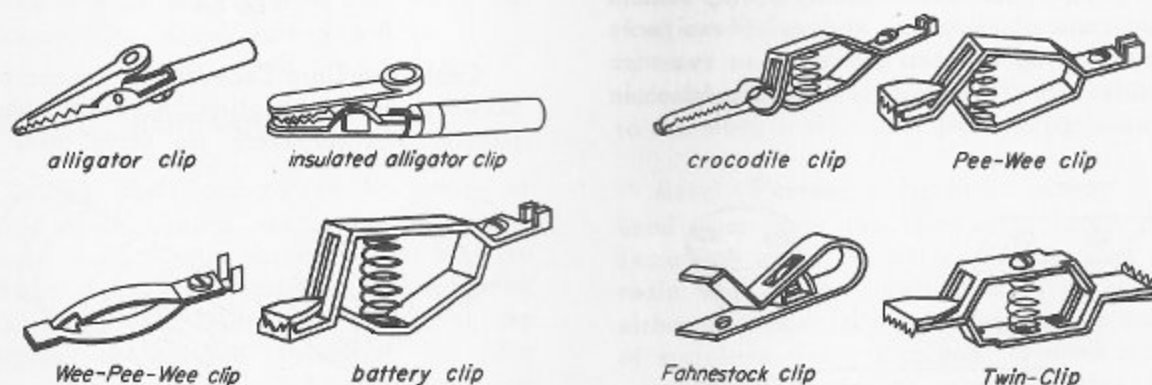


Fig. 3-2

third way uses a *fuse connector*. Many auto radios are connected to the auto battery through a fuse in one of these connectors. In this way, the radio may be easily disconnected from the power for servicing. Auto *antenna connectors*, as shown, are made in

much the same way and are also easily disconnected.

Battery Plugs. These plugs are often used in portable radios and amplifiers. Some

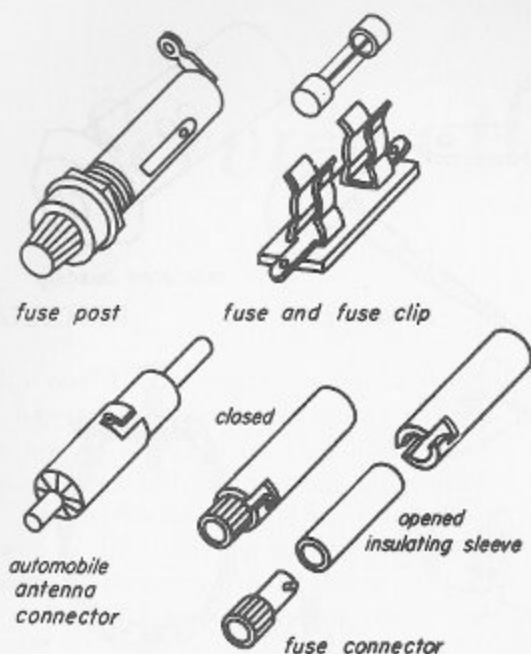


Fig. 3-3

of the more popular types are shown in Fig. 3-4. These are usually sold singly or in lots of 10 or 12.

Binding Posts, Jacks, Tips and Plugs.

Figure 3-5 shows several kinds of one- and two-wire connectors. Binding posts, banana jacks and plugs, phone tips, and phono jacks are used to connect two wires or two-wire cable. They are usually sold singly or in lots of 10 or 12.

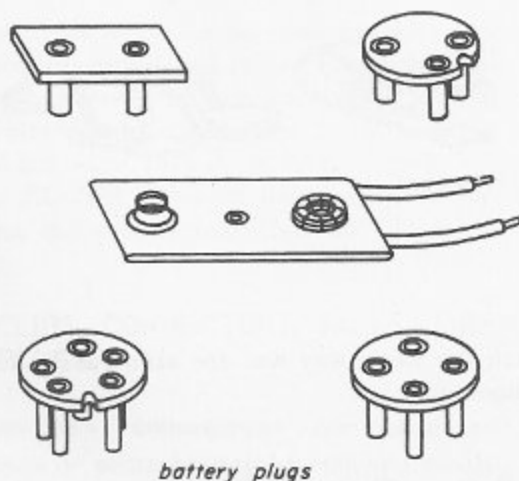


Fig. 3-4

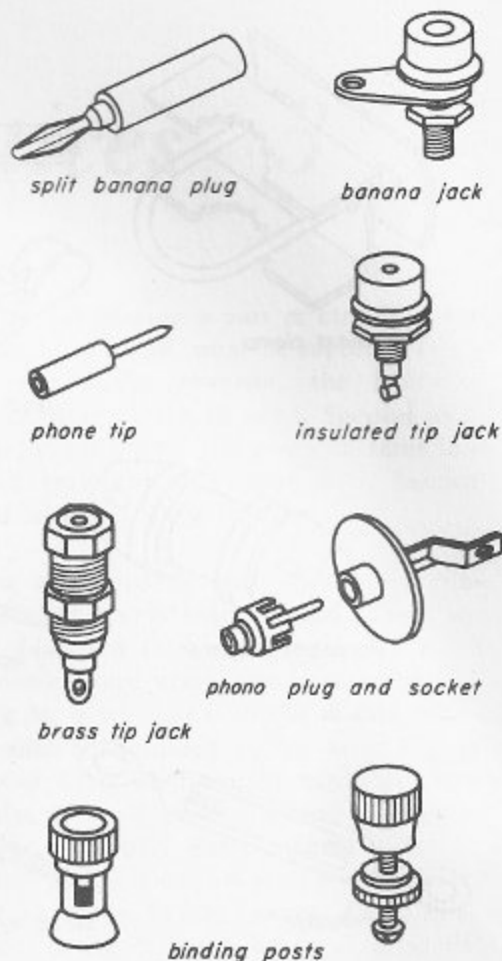


Fig. 3-5

Cable and Cord Connectors. Connections between power supplies, speakers, phone panels, and receivers are often made by

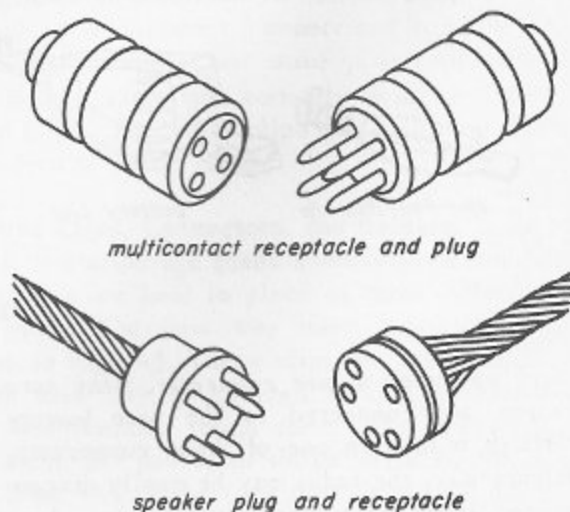


Fig. 3-6

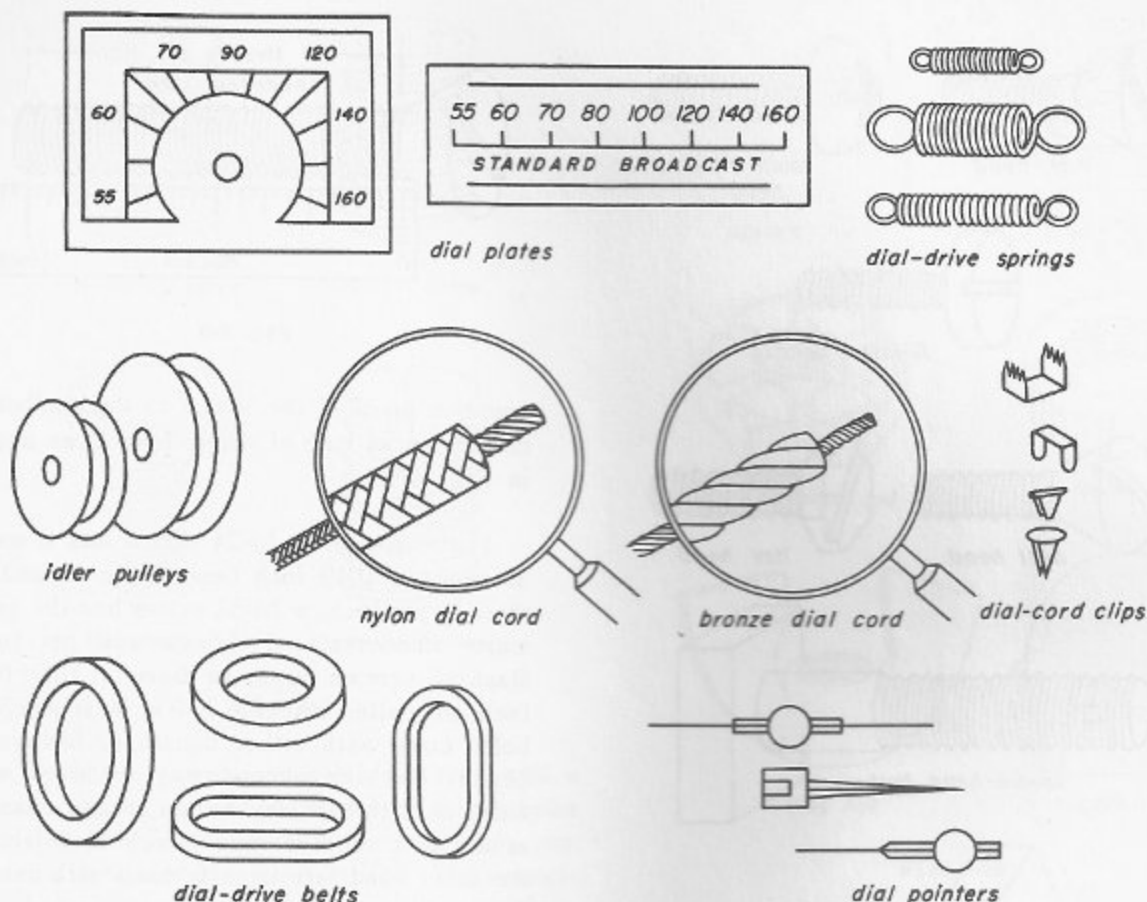


Fig. 3-7

means of a *cable* of three or more wires and connectors, as shown in Fig. 3-6.

3-4. DIAL HARDWARE

Tuning dials are turned by means of belts, cords, cables, and gears. Figure 3-7 shows some of the hardware necessary to service them. The methods of arranging the dial cords and other dials drives is the subject of Service Practices 11. The parts are shown here so that you may know what they are and what they look like.

3-5. FASTENERS

Many different devices are used to fasten parts. Among these are screws, nails, brads, staples, bolts, studs, nuts, washers, rivets, pins, and trimounts. One type of fastener supplied by the radio manufacturer may sometimes be replaced by a

another type, but in general this is not good practice. Only when you know each fastener by name and are able to tell what each size and shape is best used for will you be able to tell when a substitute part may be used.

Metal Fasteners. Machine screws are used more often than any other device for fastening metal to metal. Those used in radio and TV are usually steel or brass, although in special cases they may be made of stainless steel, aluminum, or some other metal. Machine screws are classified by length, head shape, diameter, thread, material, and finish. For example, "A 2-inch, 10-24, round-head, brass, chrome-plated machine screw" completely describes a #10 screw that has 24 threads per inch of length. As shown in Fig. 3-8, there are four popular shapes of machine screw heads: *flat*, *round*, *oval*, and *fillister*. Those used in radio may have a *slotted head*, *hexagonal head*, or a *Phillips head*.

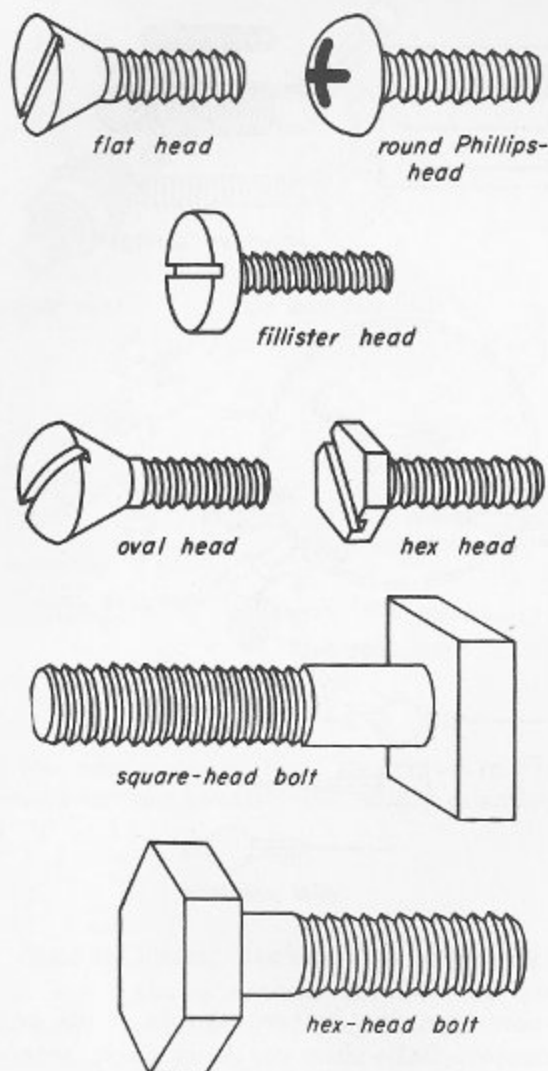


Fig. 3-8

As shown in Table A, machine screws range in diameter from 0.060 inch for #0 gauge to 0.216 inch for #12 gauge. The thread

TABLE A

Gauge	Major Diameter (inch)
0	0.0600
1	0.0730
2	0.0860
3	0.0990
4	0.1120
5	0.1250
6	0.1380
8	0.1640
10	0.1900
12	0.2160

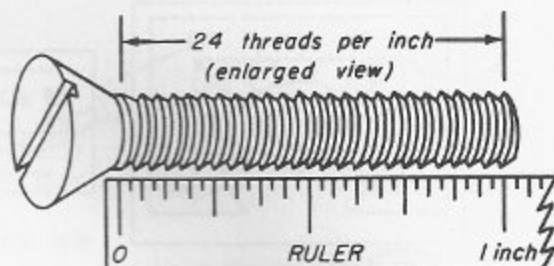


Fig. 3-9

count or *pitch* of the screw is the number of threads in an inch of screw length, as shown in Fig. 3-9.

For example: a 10-24 screw has a major diameter of 0.19 inch (see Table A) and 24 threads per inch; a 10-32 screw has the same major diameter and 32 threads per inch. Machine screws larger in diameter than 0.25 inch are called machine bolts. Most machine bolts come with either square or hexagonal heads. Machine screws may be used with nuts, or a thread may be cut in the chassis or metal to receive them. Machine bolts, on the other hand, are usually used with nuts.

Some manufacturers use *studs* to fasten chassis or phono changers to cabinets. These are screws without heads, as shown in Fig. 3-10. One end is screwed into a threaded hole in the chassis or phono changer, and the other end receives a nut.

Dials, knobs, and other parts mounted on shafts are sometimes fastened with *set screws* or *thumb screws*. Figure 3-11 shows several kinds and shapes. The Allen and bristo-headed screws need special wrenches to drive them.

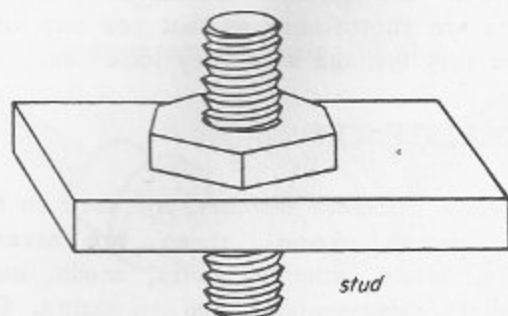


Fig. 3-10

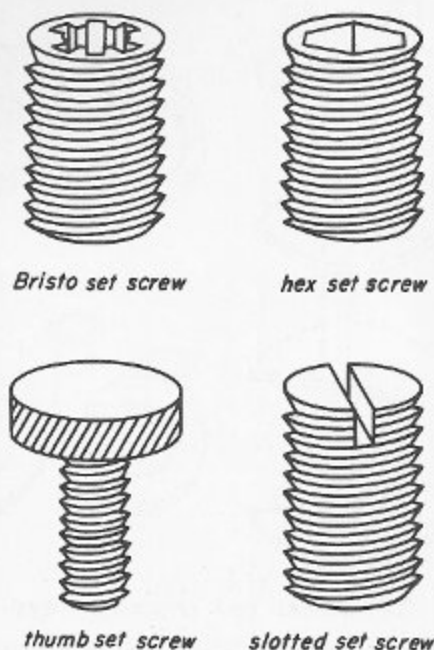


Fig. 3-11

Machine screws and bolts are used with a wide variety of nuts. Figure 3-12 shows some of them. *Square* and *hexagonal* nuts are usually tightened with a wrench. The *castellated nut* usually uses a cotter pin or safety wire to prevent the nut from falling off the screw or bolt. The screw or bolt has a hole drilled through the end to receive the pin or wire. *Wing* and *thumb* nuts tighten easily by hand so that a wrench is not necessary. *Cap* or *acorn* nuts are often used with studs and to improve the appearance of work. A nut is an *elastic* or *stop nut* when it has a built-in fibre or elastic core that prevents the nut from loosening from vibration.

Washers. When nuts are used with machine screws or bolts, *washers* are often also used. *Flat washers*, used in radio, may be made of metal, fibre, asbestos, plastic, mica, rubber, or felt. *Metal* washers are used in fastening metal to metal. *Fibre*, *plastic*, or *mica* washers are used to insulate the part being fastened from the chassis or frame to which it is being fastened. This is done, as shown in Fig. 3-13, by using the flat fibre or plastic washer and one *shoulder washer* (sometimes called an extruded washer). *Asbestos* washers are used to insulate chassis from heat. For example, when mount-

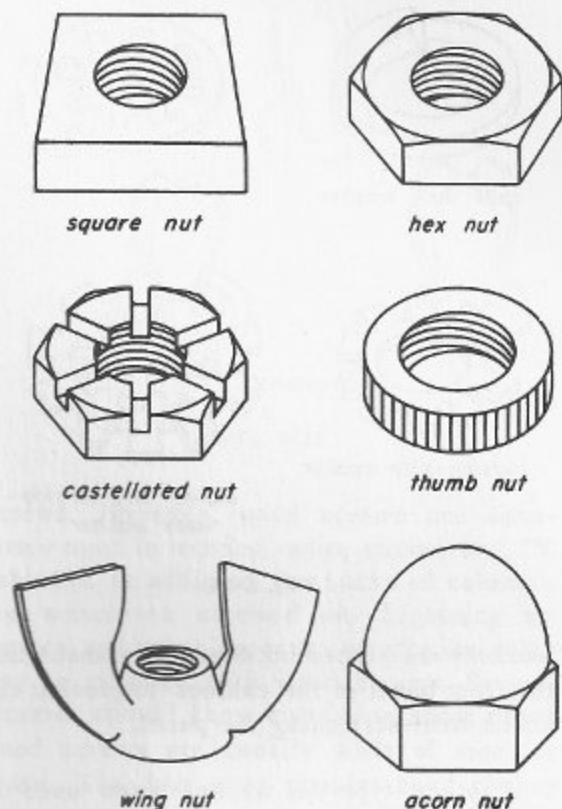


Fig. 3-12

ing a heavy-duty resistor that gives off a lot of heat, asbestos washers are used. *Rubber washers* are sometimes used to reduce the effects of vibration either when mounting a radio chassis or phono panels. *Felt*

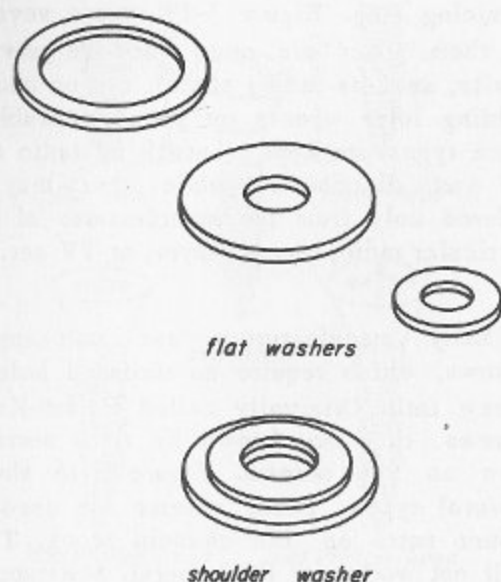


Fig. 3-13

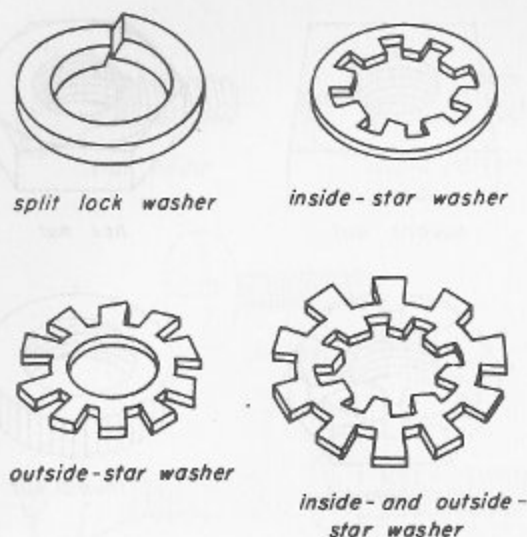


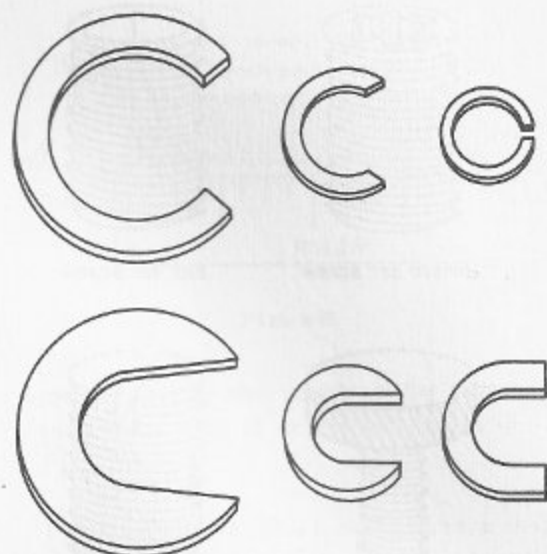
Fig. 3-14

washers are placed between radio knobs and the front panel of the cabinet to prevent the knobs from scratching the panel.

Another type of washer often used in radios is the *lock washer*. The most popular kinds of lock washers are shown in Fig. 3-14. When a nut or screw is tightened against a lock washer, the teeth or ends of the lock washer dig into the nut and the work to prevent loosening.

Two more pieces of hardware are usually listed with washers: the "C" washer and the retaining ring. Figure 3-15 shows several of them. They are often used on moving shafts, such as tuning shafts, and on shafts holding idler wheels on phono turntables. Some types are kept in stock by radio and TV parts distributors, while others may be ordered only from the manufacturer of the particular radio, phono player, or TV set.

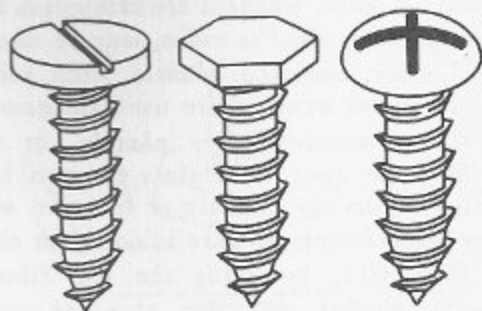
Many manufacturers use self-tapping screws, which require no threaded hole to screw into. Originally called Parker-Kalon screws, they are known by most servicemen as P-K screws. Figure 3-16 shows several types. These screws are used to mount parts on thin chassis stock. They will not work with thick metal. Self-tapping screws come with slotted heads, hexagonal heads, and Phillips heads.



"C" washers and retaining rings

Fig. 3-15

Rivets and Eyelets. Rivets are used to fasten many radio and TV parts to chassis. However, when replacing these parts, the serviceman usually uses screws and nuts. Rivets are made of soft iron or steel, brass, copper, or other metals. The size used to identify a rivet is often determined by the weight of a thousand rivets of the same size. For example, if a thousand rivets weigh ten ounces, they are called 10-ounce rivets. Rivets used in radio and TV come either by the thousand or in special assortments of from 40 to 100 rivets. They may be ordered by the diameter and length of the shank. The most often used lengths are $5/32$, $3/16$, $1/4$, and $5/16$ inch, all with a shank diameter of $1/8$ inch. Eyelets, which have a hollow shank,



P-K screws

Fig. 3-16

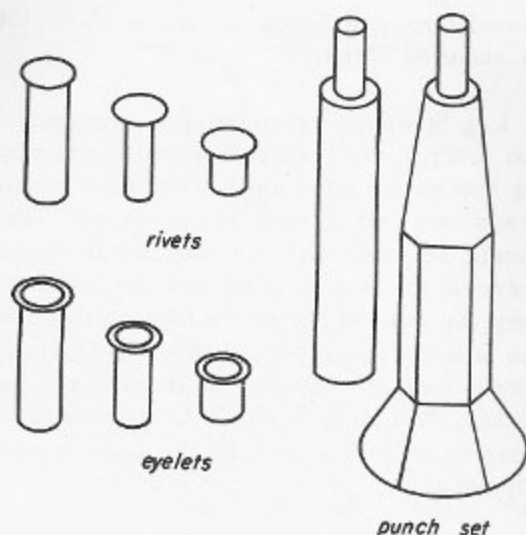


Fig. 3-17

as shown in Fig. 3-17, are also used in some receivers. They usually come in jars of about 100. The most popular sizes have a 1/8-inch shank diameter with 3/16- and 5/16-inch lengths. When an eyelet is needed, there usually is no substitute that may be used.

When first ordering rivets or eyelets, it is necessary to order a rivet and eyelet punch set, such as the one shown in Fig. 3-17. When riveting or eyeletting, great care must be taken not to damage other nearby parts on the radio chassis or phono panel.

Trimounts. Some manufacturers use a snap-on fastener for tuning dials and in similar places. This fastener is called a *trimount* (pronounced "try-mount"). Figure 3-18 shows several of the more popular types. They are usually sold by the hundred or by the thousand. The most popular sizes are made to fit a 1/8- or 5/32-inch hole. They are sold in standard packages of about 20 or 100, or in assortments of about 20 pieces. Unless large quantities are used, it usually is better to order an assortment.

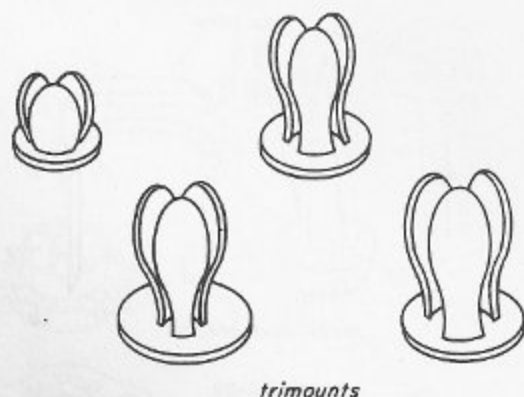


Fig. 3-18

screws. However, wood screws are sometimes used in wooden radio, phono, and TV cabinets. In addition, the backs of cabinets are sometimes screwed on. Lightning arrestors and other antenna installation parts may be mounted with wood screws. So servicemen should know something about them. Wood screws are usually made of steel or brass. The four most popular head shapes are: flat, round, oval, and fillister. The heads may have slots for a standard screw driver, or be cut for a Phillips-type screwdriver (see Fig. 3-19). Shank diameter sizes vary from 0.060 inch for #0 gauge to 0.372

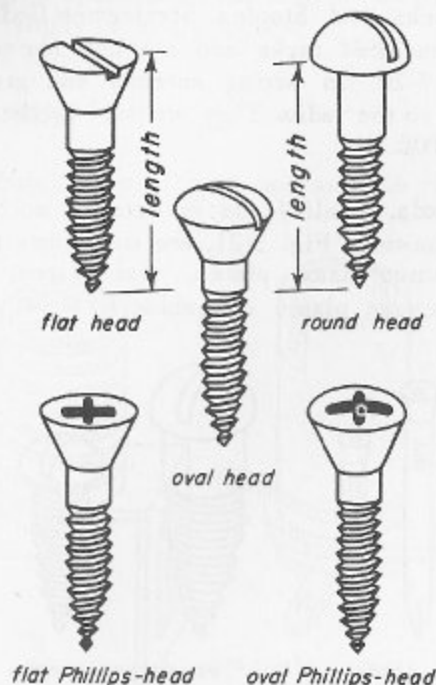


Fig. 3-19

3-6. WOOD FASTENERS

Wood Screws. Servicemen do not use nearly as many wood screws as they do machine

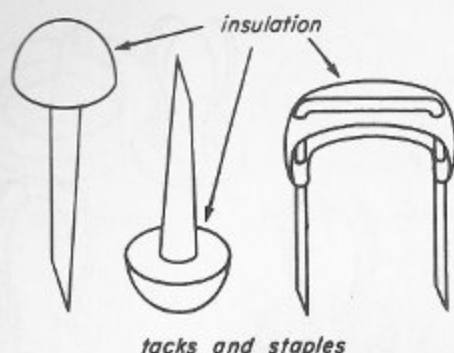


Fig. 3-20

inch for #24 gauge. They come in lengths from 1/4 inch to 3-1/2 inches in regular stock sizes. As shown in Fig. 3-19, the length of a flat-headed screw is the over-all length, while the length of the other head shapes is measured from the underside of the head to the point. Wood screws usually come in boxes of a gross, but they may be purchased in smaller quantities.

Nails. Servicemen have little use for nails. In future lessons, where nails are properly used in a serviceman's work, the size and kind of nail for each purpose will be discussed.

Tacks and Staples. Servicemen find use for insulated tacks and staples, shown in Fig. 3-20, in wiring antenna and ground leads to the radio. They are sold by the 100 or 1,000.

Brads. Small brads or screws, such as are shown in Fig. 3-21, are sometimes used to fasten name plates, dial plates, and escutcheon plates on cabinets. Most parts

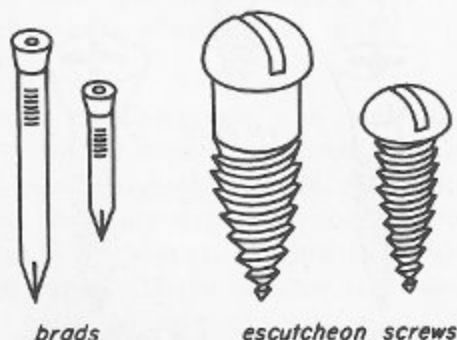


Fig. 3-21

distributors sell boxes or jars of about 100, in assorted sizes.

Lag Screws. For mounting antenna masts and other heavy pieces in wood or masonry, lag screws are often used. They have square heads and are driven by wrenches. They should be used with a heavy metal washer between the screw head and the wood to keep the head of the screw from cutting into the wood. Figure 3-22 shows a typical lag screw. Lag screws come in shank diameters of 1/4, 5/16, 3/8, 7/16, 1/2, and 5/8 inch. Lengths of from 2 to 6 inches are the most popular.



Fig. 3-22

3-7. INSULATORS AND INSULATION

You are probably familiar with the friction tape and rubber tape used by electricians in insulating wires. They are used in radio and TV too. Some special insulators and insulation are used mostly in radio and TV equipment. Figure 3-23 shows a few of them. Flexible spaghetti tubing is called that because it looks very much like spaghetti you eat, except that it is colored and is not very tasty. It is used to slip over wires and joints to protect them from other circuits. Insulated bushings and grommets are used to protect wires running from one side of a chassis to the other side, as shown. Insulated bushings and sleeves are used to protect small parts and joints.

3-8. SOCKETS

Sockets are made for electron tubes (radio tubes), neon and pilot-light bulbs, and cathode-ray tubes. In addition, a socket, bracket, and front-plate assembly is made for Magic Eye[®] tubes. There are many kinds

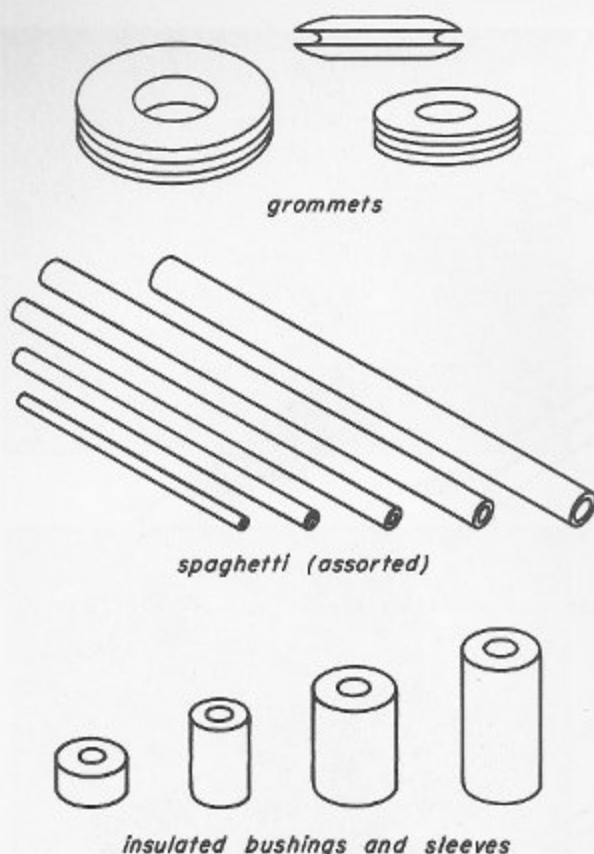


Fig. 3-23

of sockets, made of various materials in several sizes and shapes.

Tube sockets for radio receivers are made for 4-, 5-, 6-, 7-, and 8-prong standard tubes. In addition, sockets are made for 7- and 9-pin miniature tubes. Sockets for cathode-ray and television picture tubes are made for 11, 12, and 14 pins. As shown in Fig. 3-24, sockets may be very thin like the wafer socket, molded of some plastic, or made with a built-in shield. They are made of laminated bakelite, molded bakelite, mica-filled bakelite, ceramic, steatite, and other plastic materials. Sockets are usually sold singly or by the dozen.

Magic Eye® assemblies come for either 6- or 8-prong magic eye tubes. A *Magic Eye*® assembly is shown in Fig. 3-25.

Pilot Light sockets come with a wide variety of mounting brackets. Most modern receivers use a socket that is made for a

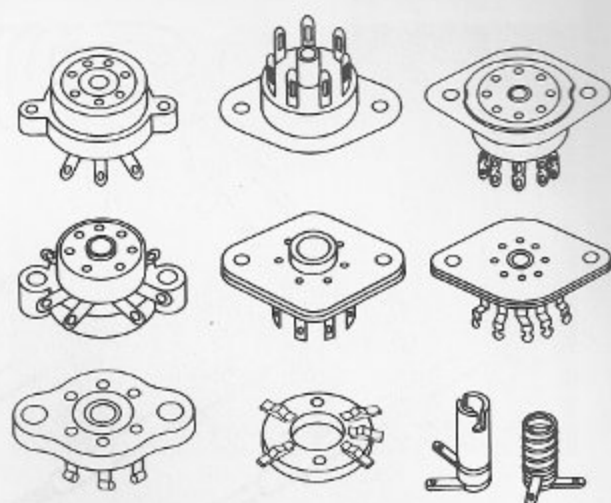


Fig. 3-24

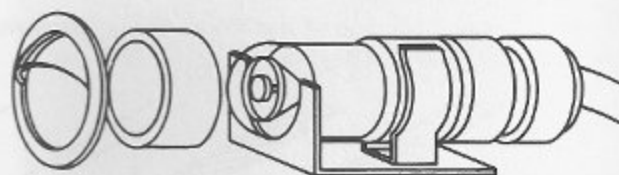


Fig. 3-25

pilot light with a bayonet base. However, older receivers use a screw-type socket. As shown in Fig. 3-26, some come with a jewel or bull's eye. Pilot light sockets are usually sold singly or by the dozen.

3-9. WIRE

Many kinds of wire are used in making

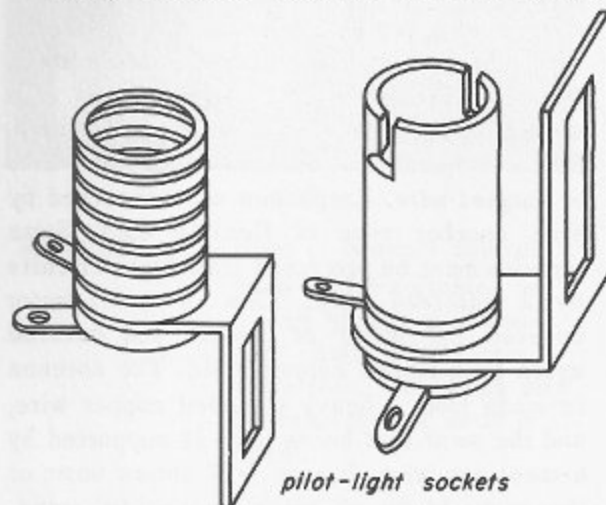


Fig. 3-26

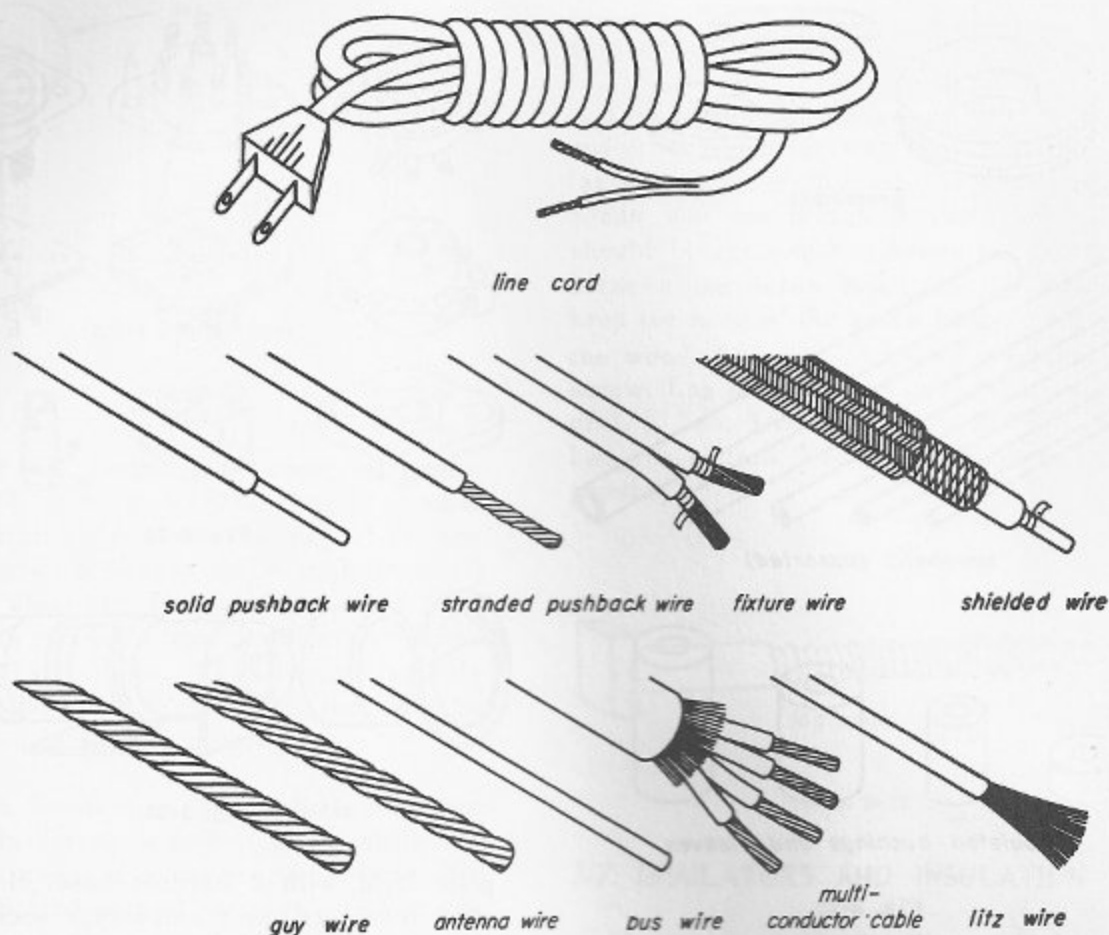


Fig. 3-27

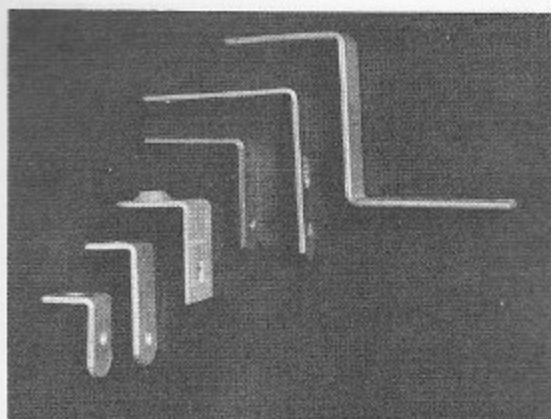
and installing radio and TV sets. For wiring, we most often use *push-back solid* or *stranded* wire. Sometimes, however, *bus-bar* wire, either round or square, is used. For wiring ground or antenna leads inside the house, *fixture wire*, which is stranded and covered with rubber and a cotton braid is often used. Power is brought to the set by means of a stranded double conductor called a *line cord*. Radio frequency coils are wound with *Litz* or *magnet wire*. Earphones are connected by still another type of flexible cord. Some circuits must be protected from other circuits by a *shielded wire*. This is a conductor covered by rubber or plastic and covered again by a tinned copper braid. The antenna is made from a heavy stranded copper wire, and the mast that holds it up is supported by a steel *guy wire*. Figure 3-27 shows some of the many kinds of wires and cables used. Most wire used in radio and TV sets is sold

in 50- and 100-foot rolls and 1,000-foot reels. Special cables are also sold by the foot. The sizes of wire used are given in the lessons that discuss their use.

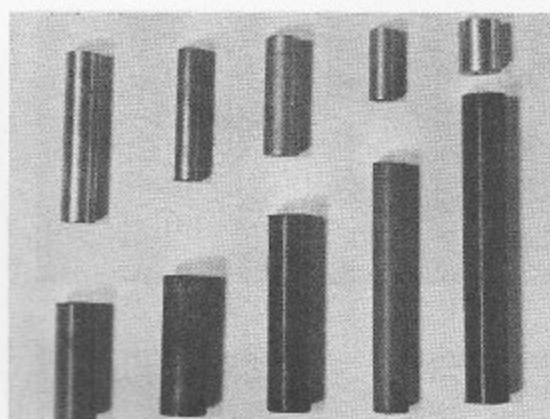
3-10. MISCELLANEOUS HARDWARE

Special radio hardware not included in the other sections of this booklet are illustrated in Figs. 3-28 and 3-29. Each piece of hardware in these illustrations is identified by a letter. The lists below both illustrations give the name of each part that is shown and a brief description of what each part is used for in radio and television receivers.

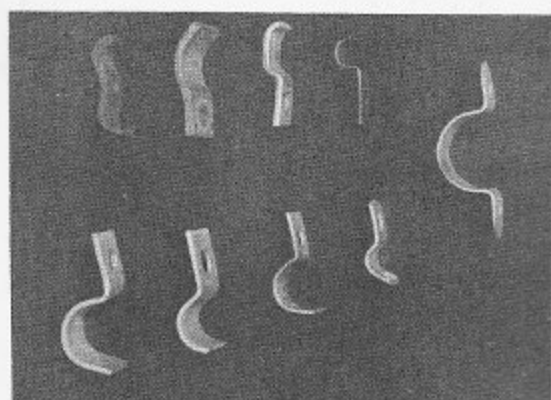
Examine these illustrations carefully. Try to learn as much as you can about what the hardware shown looks like.



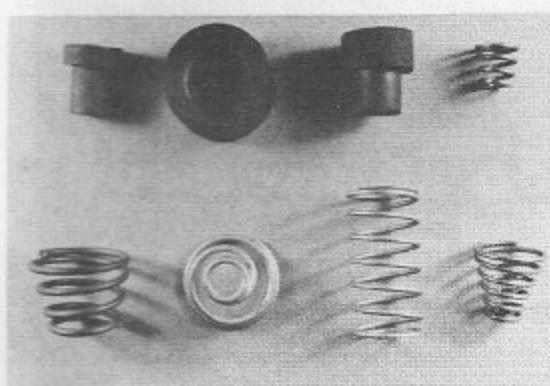
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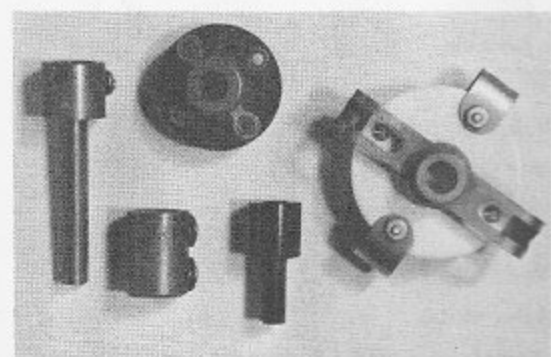
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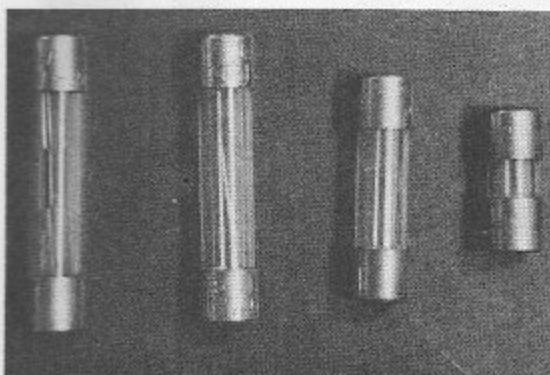
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(e)



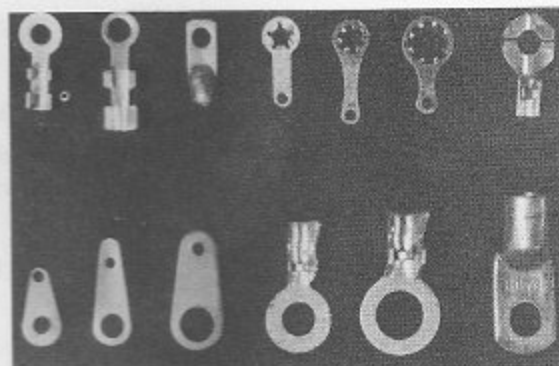
(f)

- a. Angle brackets — Used to mount small parts in a receiver.
- b. Bushings — Used to separate sections or to mount parts away from chassis frame.
- c. Cable clamps — Used to tie radio cable to the chassis.
- d. Chassis mounts — Used to reduce chassis vibration
- e. Couplings — Used to connect control knob shafts to tuning or switch shafts or to connect shafts of different diameters. Couplings may be insulated or made of metal.
- f. Fuses — Used to protect radio equipment.

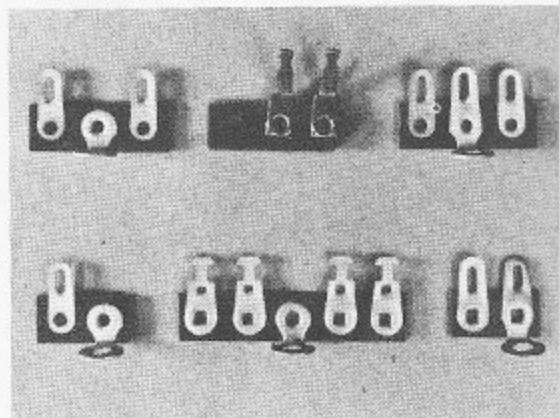
Fig. 3-28 Miscellaneous Hardware



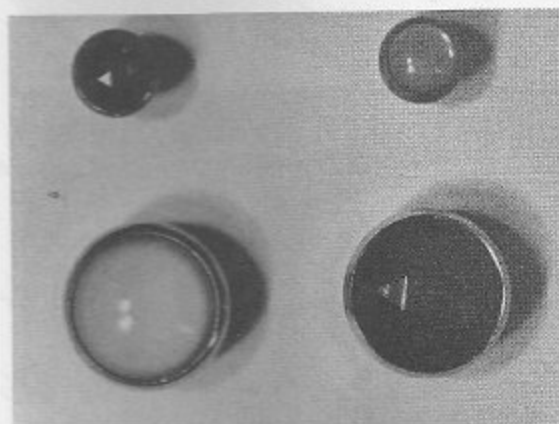
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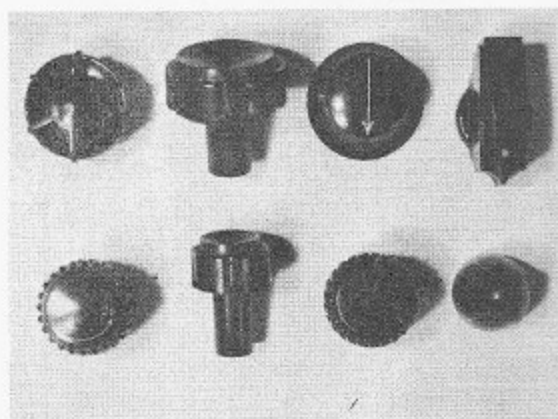
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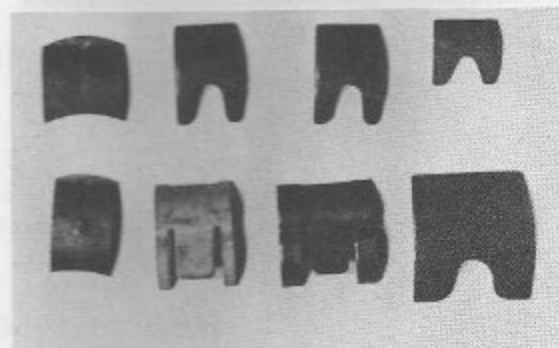
(c)



(d)



(e)



(f)

a. Grid caps and clips – Used to connect the tube control grid to the grid

b. Lugs – Used in soldering connections to radio and TV circuits.

c. Terminal strips – Used to mount parts and to solder circuits together.

d. Jewels – Used for dressing up pilot lights.

e. Knobs – Used to turn shafts in control circuits.

f. Knob springs – Tension springs; used to hold knobs on shafts of controls.

Fig. 3-29 Miscellaneous Hardware